

# Prevalence of sharp injuries among residents of surgical specialties in Saudi Arabia

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**ABSTRACT**

**Introduction:** Surgical residents are at risk to get infected with hepatitis C virus, hepatitis B virus and human immunodeficiency viruses, due to sharp injuries. Our aim is to assess the level of awareness, and the risk factors also illustrate the causes regarding the risk of Sharp injuries among surgical resident specialty Saudi Arabia. **Methodology:** This is a cross-sectional, study conducted in all Saudi Arabia regions. A total of 314 residents at any surgical field included in this study; in which the participated self-administered questionnaire that addressed if the participant had experienced any sharp-related injuries in the last year and assessed the level of awareness of residents. **Results:** Half of the participated residents have had a sharp injury during the past year. 66.9% of residents had been injured for 1-3 times in the last year, and 63.1% were aware of the policies toward the sharp injuries. Self-induced injuries were observed the most (74.5%). High risk injuries were reported among 24.2% of residents. 8 types of were recorded when sharp injured occurred, Suturing was the highest rate (80.9%), followed by "Loading" a needle (57.3%). **Conclusions:** The findings of the study indicate that majority of the sample experienced a sharp injury 1-3 times in the previous year, with the vast majority being self-inflicted, and the most frequent incidence of injury being a rush during a procedure. It is critical to act and raise knowledge about the risk factors for sharp injuries, as well as urge reporting of such incidents.

**Keywords:** Sharp injury, knowledge, attitude, practice, Saudi Arabia, surgical resident, blood borne, healthcare.

**1. INTRODUCTION**

Acute injuries are any penetrating wounds from a needle, scalpel, or other sharp object that led to injury or disease. The risk is the transmission of some life-threatening diseases such as hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency viruses (HIV) (Aljiffry et al., 2018). Acute infection is one of the most common work-related dangers for health care workers (HCWs), and they are also particularly prone to blood-borne pathogen contamination (Kaur et al., 2014). There are records of 385,000

needle sticks and other acute related accidents involving healthcare workers each year (Bernard et al., 2013). Due to the nature of their employment, several types of healthcare workers are at a higher risk of harmful unintentional exposure. Like the surgeons, trainees, and surgical staff (Choi et al., 2017), In Saudi Arabia, there is a limitation of data on occupational exposure to blood and body fluids. The mean prevalence of NSSI was 33 per 1,000 healthcare workers over 4 years of research in a retrospective study conducted at a tertiary care center in Saudi Arabia (Samargandy et al., 2016). According to studies, the diseases (HBV), (HCV), and (HIV) are among the most prevalent pathogens transmitted to health care professionals in that field (Sepkowitz, 1996).

According to a study conducted by Annette et al., (2005), the total infection rate among healthcare workers in 14 geographic locations was 16,000 HCV, 66,000 HBV, and 1,000 HIV infections probably occurring in the year 2000 due to occupational exposure to the skin Injuries (Prüss-Üstün et al., 2005). While a study conducted on Ministry of Health hospitals in the Kingdom of Saudi Arabia estimated that the rate of skin infections reported in Saudi Ministry of Health hospitals in 2012 from doctors in the operating / resuscitation room was 69 despite the number of unreported cases (Memish et al., 2015). Other research shows that 83% of residents / colleagues, and 100% of faculty have experienced a serious injury at some point in their careers; 42% of residents / colleagues had severe exposure during the past year (Bernard et al., 2013). In the operating room, surgical residents are at risk of developing blood-borne infections due to their exposure to needles and other sharp tools (Aljiffry et al., 2018), as is always the case in the operating room (Choi et al., 2017), acute injury can cause transmission in at least 20 different pathogens (Farsi et al., 2012).

However, percutaneous injury is a common high risk for those residing in surgery (Hashmi et al., 2012). One of the most serious issues is that some health practitioners fail to report this problem after becoming aware of it, which can lead to higher risks and a lack of prevention plans. Hospitals and health centers pay great attention to this problem and focus on it to reduce injuries or non-occurrence in the first place through awareness-raising lectures for all medical and health personnel and everyone who communicates directly with patients. Infection control in hospitals, which includes, wearing gloves and disposing of sanitary waste in authorized areas, as well as other personal protective equipment, is one of the most critical awareness presentations. This model presents an obvious problem as research has shown that these injuries are underreported in the surgical field (Choi et al., 2017) and there is poor adherence to protected surgical practices among surgical residents. Despite the fact; that surgical interns are aware of the standard procedures for preventing acute injuries in the operating theatre (Aljiffry et al., 2018). There has been previous research examining blood-borne infections among surgeons, but few studies have included multiple institutions (Choi et al., 2017).

The most common research method adopted by other researchers of the same topic is the cross-sectional descriptive study, which will also be applied to this research. The goal of this study is to assess the frequencies, comorbidities, and predictors of sharp injuries among surgical residents in several centers across Saudi Arabia.

## 2. METHODS

### Data collection

This is a cross-sectional based study, this study was conducted in all over Saudi Arabia regions including both male and female resident at any surgical field. The population included was the residents in different surgical specialties (general surgery, thoracic surgery, colon and rectal surgery, ophthalmic surgery, oral and maxillofacial surgery, orthopedics, neurosurgery, urology, pediatric surgery, plastic surgery, vascular surgery, cardiac surgery, ENT, and obstetrics and gynecology). Exclusion criteria were any resident at non-surgical field in Saudi Arabia. A total of 314 residents were available for inclusion in the study during the designated time interval (June -December 2020).

A questionnaire was sent using E-mail, text messages, or contacting the residents directly in hospital. The research tool used to collect the data was a modified questionnaire made up from previous similar studies. The first part was about the demographic data including gender, nationality, specialty, residency level and Program region. The questionnaire then addressed whether the participant had experienced any sharp-related injuries in the last year, the number of sustained injuries, if they ever had experienced injuries involving a high-risk patient, Six questions then followed about investigating the surrounding circumstances, most probable cause, instrument involved, type of injury, time of injury and the task taken when injury took place plus five questions evaluating the attitude, awareness and adherence to local safety policies, as well as conduct toward injuries and actions taken to report them. Finally, four yes/no questions were used to assess participants' understanding of universal precautions (double-gloving, eye protection, and no-touch method), as well as whether they had ever participated in any sharps-related safety training.

### Data Analysis

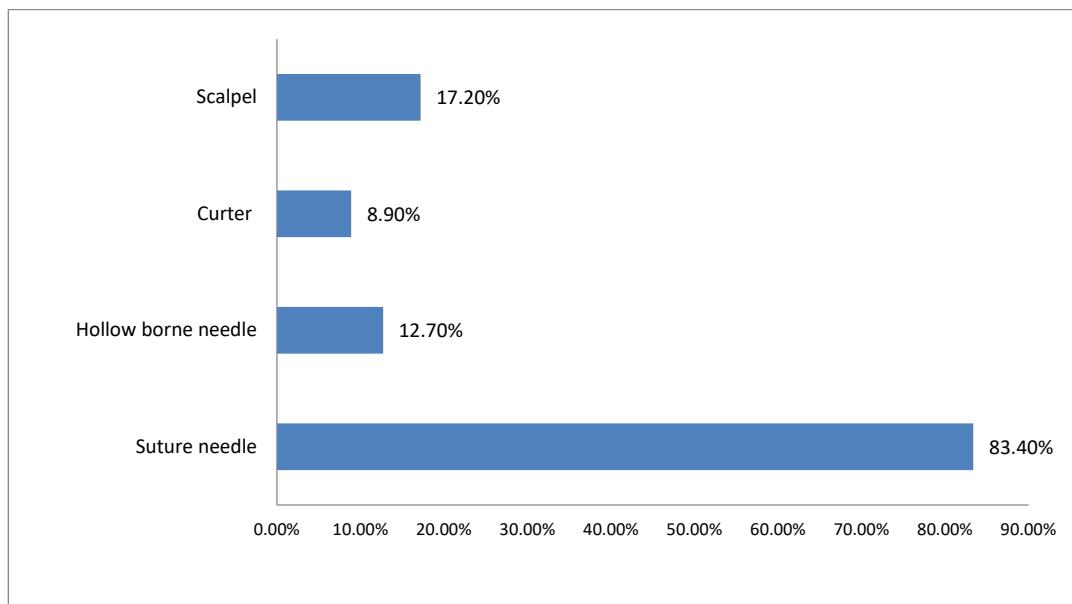
Data was analyzed using SPSS version 23.0. The frequencies, percentage, mean and standard deviation were conducted to describe the variables; The Pearson's Chi square ( $\chi^2$ ) was used to test the association between resident data and sharp injuries. A p value at (0.05) was considered statistically significant.

### Ethics

Prior to the start of the research, the Medical Research Ethical Committee of Al Imam Mohamed Ibn Saud Islamic University gave its clearance. Participants signed an informed consent which explained the purpose of the study and the rights of the participant for confidentiality and withdrawal at any time without any obligation towards the study team. Participant's anonymity has been assured by assigning each participant with a code number for analysis only.

## 3. RESULTS

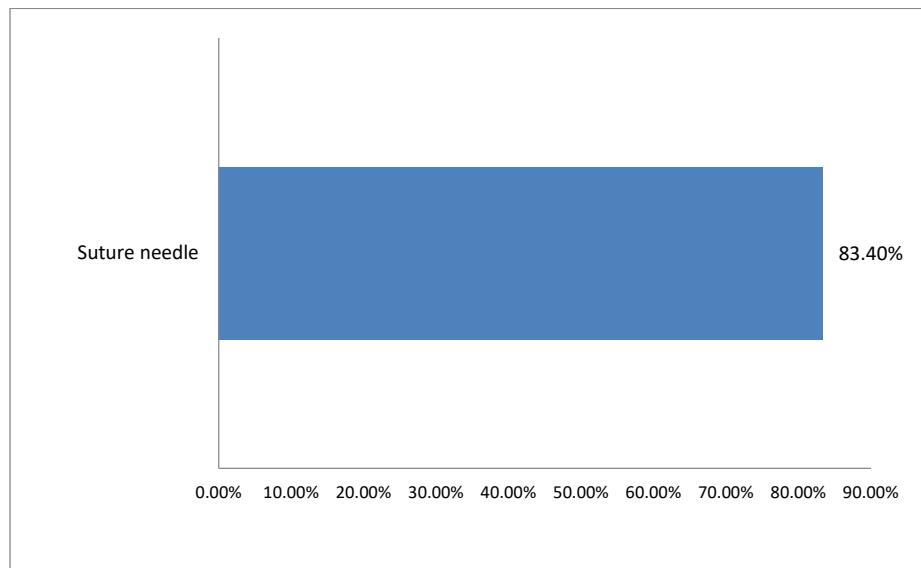
A total of 314 inhabitants took part in the current study, with 50% of them having suffered an acute injury in the previous 12 months. 66.9% of residents had been injured for 1-3 times in the last year ( $p<0.05$ ). Self-induced injuries were observed among 74.5% ( $p<0.05$ ) (Table 1). High risk injured was reported among 24.2% of injured resident ( $p<0.05$ ). 8 types of were recorded when sharp injured occurred, Suturing was the highest rate (80.9%) ( $p<0.05$ ), followed by "Loading" a needle (42.7%) ( $p>0.05$ ), (Figure 1) the rest types recorded below 50% ( $p<0.05$ ) with a consideration of the lowest rate for Disassembling needle or sharp device (3.2%). Most of the injuries were due to suture needle (83.4%) and this confirms the fact that suturing is the highest type of injury among surgical resident, followed by Scalpel (17.2%) mainly during surgical procedure while the curter has the lowest rate (8.9%), (Figure 2).



**Figure 1** Type of procedure have got the injuries

**Table 1** pattern of sharp injuries

Statement	N(%)	p
Number of needle-stick injuries	1-3	<0.000*
	4-10	
	>10	
	I don't know	
Involving a "high risk" patient	No	<0.000*
	Yes	
Was your most recent needle stick?	Self-induced	<0.000*
	By someone else	

**Figure 2** Type of sharp instrument have caused sharp injuries

As shown in Table (2) sharp injury statue with resident's sociodemographic information was presented. Female residents were higher than that male (54.4 vs. 44%, respectively) ( $p>0.05=0.07$ ), while Saudi record significantly of higher injury than that of Non-Saudi (52.9% vs.28.9, respectively) ( $p<0.05=0.006$ ). It is shown that the highest rate was reported among Plastic and Maxillofacial Surgery (92.9%), followed by Oral and Maxillofacial Surgery (75%), then Neurological Surgery (70%),while Vascular Surgery and Gynecologic Oncology had not injured ( $p<0.05$ ). R4 residents recorded the highest injury rate (63.3), followed by R3,R6,R5 and R2, which ranged between 56.1% and 51%,while 35.1% of R1 residents were injured ( $p<0.05$ ). Central region residents recorded the highest injury rate (63.4%), followed by Southern region (58.3%), and Eastern region (57.8%), then Western region (45.6%) while 20.5% of Northern region residents were injured ( $p<0.05$ ).

**Table 2** Demographic information distribution in term of injury rates by residents

Sociodemographic information		Sharp injury in the past year		p
		Yes N (%)	No N (%)	
Gender	Male	98(54.4)	82(45.6)	0.07
	Female	59(44)	75(56)	
Nationality	Saudi	146(52.9)	130(47.10)	0.006*
	Non-Saudi	11(28.9)	27(71.10)	
Specialty according to the American College of Surgery	General Surgery	80(53)	71(47)	<0.000*
	Gynecologic Oncology	0	7(100)	
	Neurological Surgery	7(70)	3(30)	
	Obstetrics and Gynecology	9(25.7)	26(74.3)	
	Ophthalmic Surgery	8(57.1)	6(42.9)	
	Oral and Maxillofacial Surgery	6(75)	2(25)	
	Orthopaedic Surgery	18(69.2)	8(30.8)	
	Otolaryngology	8(30.8)	18(69.2)	
	Pediatric Surgery	5(55.6)	4(44.4)	
	Plastic and Maxillofacial Surgery	13(92.9)	1(7.1)	
	Thoracic Surgery	1(50)	1(50)	
	Urology	2(20)	8(80)	

	Vascular Surgery	0	2(100)	
Residency Level	R1	33(35.1)	61(64.9)	0.02*
	R2	26(51)	25(49)	
	R3	37(56.1)	29(43.9)	
	R4	31(63.3)	18(36.7)	
	R5	16(55.2)	13(44.8)	
	R6	14(56)	11(44)	
Region of residency program	Central region	59(63.4)	34(36.6)	<0.000*
	Eastern region	26(57.8)	19(42.25)	
	Western region	57(45.6)	68(54.4)	
	Southern region	7(58.3)	5(41.7)	
	Northern region	8(20.5)	31(79.55)	

\* p<0.05

Table 3 shows the device used and causes of sharp injured. 10 device types used, Suturing and tying sutures was the most used one (52.9%) (p>0.05), followed by Needle / sharp insertion 41.4% (p<0.05), then Needle / sharp manipulation (33.8%) (p<0.05). Sharp object dropped during procedure was the less type used (4.5%) (p<0.05). 53.5% of residents recorded that morning shift is the time when needle stick happened, followed by On call (30.6%), and then night shift (15.9%), and 43.3% reported that some sharps injury notified to concerned authorities(p<0.05). Rushed is the most cause of sharp injured (54.8%) (p>0.05), followed by Prolong work hours (33.1%) (p<0.05), and then Lack of assistance and Fatigue (28%) (p<0.05), while could not have been prevented is the less cause (12.7%) (p<0.05).

**Table 3** device used and causes of sharp injured

Statement	N (%)	p
Device used		
Patient moved and jarred device	No 146(93)	<0.000*
	Yes 11(7)	
Suturing and tying sutures	No 74(47.1)	<0.37
	Yes 83(52.9)	
Needle / sharp insertion	No 92(58.6)	<0.03*
	Yes 65(41.4)	
Needle / sharp manipulation	No 104(66.2)	<0.000*
	Yes 53(33.8)	
Needle / sharp withdrawal	No 123(78.3)	<0.000*
	Yes 34(21.7)	
Receiving equipment	No 140(89.2)	<0.000*
	Yes 17(10.8)	
Sharp object dropped during procedure	No 150(95.5)	<0.000*
	Yes 7(4.5)	
Collision with a coworker during procedure collision with sharp during procedure	No 144(91.7)	<0.000*
	Yes 13(8.3)	
Incising	No 140(89.2)	<0.000*
	Yes 17(10.8)	
Palpating / exploring the operative field	No 148(94.3)	<0.000*
	Yes 9(5.7)	

What was the time when needle stick happened?	Morning shift	84(53.5)	<0.000*
	Night shift	25(15.9)	
	On call	48(30.6)	
The cause of sharp injured			
Lack of assistance	No	113(72)	<0.000*
	Yes	44(28)	
Lack of skill set required	No	132(84.1)	<0.000*
	Yes	25(15.9)	
Fatigue	No	113(72)	<0.000*
	Yes	44(28)	
Rushed	No	71(45.2)	<0.23
	Yes	86(54.8)	
Could not have been prevented	No	137(87.3)	<0.000*
	Yes	20(12.7)	
Prolong work hours	No	105(66.9)	<0.000*
	Yes	52(33.1)	
Lack of sleep	No	119(75.8)	<0.000*
	Yes	38(24.2)	
Number of sharps injury notified to concerned authorities?	All	34(21.7)	<0.000*
	Some	68(43.3)	
	None	55(35)	

\* p<0.05

Table 4 reported the actions and reasons for non-reporting, 40.8% of residents reported to observe each phase of the local policymaking process. If exposed to sharp injury (p<0.05). Resident's students reported that the reasons for non-reporting with advantage for thought patient is a low-risk patient (53.5%) (p>0.05), followed by no spare time (40.8%) (p<0.05), and then unknowing they had to (22.3%), while post exposure prophylaxis ineffective the less reasons for non-reporting (p<0.05).

**Table 4** actions and reasons for non-reporting

Statement		N (%)	p
What action do you most commonly take if you exposed to sharp injury?	Ignore and continue	29(18.5)	<0.000*
	Replace gloves, replace needle	45(28.7)	
	Inform scrub nurse	19(12.1)	
	Follow each step of local policy	64(40.8)	
The reasons for non-reporting			
Could not spare time	No	93(59.2)	<0.000*
	Yes	64(40.8)	
Did not know I had to	No	122(77.7)	<0.000*
	Yes	35(22.3)	
Not bothered	No	127(80.9)	<0.000*
	Yes	30(19.1)	
Thought patient to be low risk	No	73(46.5)	<0.38
	Yes	84(53.5)	
Don't want to disrupt operating list	No	130(82.8)	<0.000*

	Yes	27(17.2)	
Did not know how to	No	123(78.3)	<0.000*
	Yes	34(21.7)	
Afraid positive result may affect my career	No	135(86)	<0.000*
	Yes	22(14)	
Post exposure prophylaxis ineffective	No	139(88.5)	<0.02*
	Yes	18(11.5)	

\* p<0.05

Table 5 presents the relation between precautions awareness and practice with every surgical case among resident's students during the previous 12 months. 63.1% were aware of the policies toward the sharp injuries, 62.4% have used No-touch technique for needle (p>0.05), however, and 43.9% able to follow with difficulty (p<0.05), 41.7% had considered their policy is friendly (p>0.05). In term of precautions, only 41.4% used double gloving (p>0.05), 35% practicing visor/other eye protection. 43.9% practiced Sharps related safety training (p>0.05).

**Table 5** precautions awareness and practice with every surgical case

Statement	Sharp injury in the past year			p
	Total N (%)	Yes, N (%)	No, N (%)	
Awareness of the local sharps policy and procedures	No	116(36.9)	60(51.7)	0.64
	Yes	198(63.1)	97(49)	101(51)
How user friendly is your policy?	User friendly	131(41.7)	50(38.2)	<0.000*
	Able to follow but with difficulty	138(43.9)	74(53.6)	
	Difficult to follow	45(14.3)	33(73.3)	
Double-gloving	No	184(58.6)	86(46.7)	0.17
	Yes	(130(41.4)	71(54.6)	
Visor/other eye protection	No	204(65)	101(49.5)	0.81
	Yes	110(35)	56(50.9)	
No-touch technique for needle	No	118(37.6)	66(55.91)	0.10
	Yes	196(62.4)	91(46.4)	
Sharps related safety training	No	176(56.1)	88(50)	1.00
	Yes	138(43.9)	69(50)	

\* p<0.05

#### 4. DISCUSSION

Sharp injuries are considered one of the most major elements of blood-borne infection, especially among surgical residents. Our purpose is to understand the incidence, causes, and risk factors of blood-borne injuries besides assessing the level of awareness of the residents regarding the risk of Sharp injuries as they were more susceptible to the blood-borne injuries. In this study 66.9% of residents had been injured 1-3 times in the last year in addition to study was conducted in Chennai Medical College Hospital in India showed almost the same results (64%) but it was among all health worker although a study in Abha showed 79.5% of sharp injuries was reported by surgical residents (Alqahtani et al., 2019; Anupriya & Manivelan, 2015). 74.5% of injuries were self-induced injuries especially during suturing which is about 80.9% therefore it has the highest rate as the leading cause of serious injuries. Also, the same study showed that 86% of sharp injuries were self-induced and 53.3% of residents were injured during suturing and 16.8% during replacing the needle (Alqahtani et al., 2019).

A study in Maternity and Children's Hospital in Najran showed almost the same results, the most common cause of injuries was suturing followed by drawing of venous blood samples and mainly these injuries occur in operating/recovery room However, the

majority of injuries were superficial with little or no bleeding, with only 2% of severe deep stick/cut injuries resulting in profuse bleeding (Hashmi et al., 2012). The high-risk patient, who has a history of HBV, HCV, or HIV, was responsible for 38% of needle-stick injuries among surgical residents, on the other hand, a study published in The New England Journal of Medicine estimated around 53% of needle stick injuries were involved high-risk patients (Alqahtani et al., 2019; Ncube et al., 2008). Among all the years of resident surgeons, the fourth R4 residents had the highest rate followed by R3, R6, R5, and R2, which ranged between 56.1% and 51%, while 35.1% of R1 residents were injured and this is most likely due to the lack of tasks that expose them to the sharp injuries while a study published in King Abdelaziz University in Jeddah showed a dramatic increase in the rate of injury with each additional year up to 100% in the R5 and R6 residents (Aljiffry et al., 2018).

The most prevalent factor that contributed is the procedure's haste at the rate of 54.8% followed by prolonging work hours (33.1%) and then lack assistance and fatigue (28%), while in King Khalid University showed (76.6%) was related to fatigue followed by rushed (65.4%), (Alqahtani et al., 2019). Following an injury, the vast majority (40.8 percent) elected to follow every step of municipal regulation. While 28.7% chose to replace gloves and needles and 12% chose to inform the scrub nurse. On the other hand, according to a research conducted at Royal United Hospital, the majority of patients preferred to report it to the scrub nurse, and changing gloves and needles was the most favored course of action (Thomas & Murray, 2009). However, non-reporting sharp injuries are considered one of the most prevalent issues in many places around the world. Only 18.5% chose not to report by ignoring the injury and continuing their work, Contrary to what was shown in the Abha study, the percentage of those who did not report their sharp injuries was 49% and this is considered a high percentage when compared to our study (Alqahtani et al., 2019).

Low-risk patients are the main reason for underreporting in this study followed by no spare time to report and this is like another study they believed that the patients who were considered as low risk seem to have a significant influence on doctors' attitudes toward injuries (Thomas & Murray, 2009). Another study showed that the time-consuming reporting procedure is considered the main cause for underreporting (Kennedy et al., 2009). Fortunately, 63.1% were aware of the policies toward sharp injuries. Also, 41% found that the policy is friendly and easy to implement in the current study. Multiple studies besides the current study showed the importance of precaution among surgical residents which represents by non-touch technique for needle, double-gloving and visor or other eye protection and (Alqahtani et al., 2019; Aljiffry et al., 2018).

Finally, our study showed some limitation the most important one is small sample size which is expected because low response rate and it is considered one of feature of survey-based studies. Furthermore, this study exclusively included surgical residents, who are more likely to be harmed in the operating room compared to other health-care workers.

## 5. CONCLUSION

In conclusion, this study was carried out to determine methods to minimize the prevalence of sharp injury among surgical residents in several Saudi hospitals. among 314 participants 50% have had a sharp injury during the past 12 months about 1-3 times and the vast majority were self-induced injuries and the most prevalent reason of injury was revealed to be rush during procedures. We have showed in our study that main reasons for underreporting were thought that patient is low risk and the lack of time. The health and safety among both doctors and patients are crucial, it is vitally important to take action and promote awareness of risk factors to sharp injuries and encourage reporting such incidence.

### Acknowledgement

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### Statement of Ethics

This study protocol was reviewed and approved by Institutional Review Board (IRB) committee of Al-Imam Muhammad Ibn Saud Islamic University. Chairman Prof. AbdulAziz Al-Akaabba and IRB member Dr. Arezki Azzi, project approval number: 61-2020. Informed consent was obtained from all participants, they all informed that the study was completely nameless and dedicated for scientific and research purposes only.

### Author Contributions

Abdulaziz Alajalin and Nawaf Almutairi planned the project and supervised the findings of this work. Nawaf generated the idea, design, data collection, data analysis, editing, writing proposal, literature review and writing manuscript. Sadin Alhazmi: writing the proposal, literature review, writing manuscript, critical revision of the article and proofreading. Shuruq Alshammari

contributed in the interpretation of the data, writing manuscript, and writing and revising the manuscript. Fahad Alkhalfaf: writing proposal, literature review, and data collection. Abeer Alhazmi: data collection and contributed to the final manuscript. Abdulaziz Alajalin and Nawaf Almutairi revised and verified the manuscript before submission.

### Funding

This study has not received any external funding.

### Conflict of Interest

The authors declare that there are no conflicts of interests.

### Data and materials availability

All data associated with this study are presented in the paper. Further inquiries can be directed to the corresponding author.

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